Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
The 4.9 GHz Band Transferred from Federal Government Use	)	WT Docket No. 00-32
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To: The Commission	)	

REPLY COMMENTS OF THE NATIONAL PUBLIC SAFETY TELECOMMUNICATIONS COUNCIL TO COMMENTS IN OPPOSITION TO ITS PETITION FOR RECONSIDERATION

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The National Public Safety Telecommunications Council ("NPSTC") hereby respectfully submits the following Reply Comments to Comments filed in opposition to the NPSTC Petition for Reconsideration in response to the Commission's *Memorandum Opinion and Order and Third Report and Order*, FCC 03-99 (released May 2, 2003) ("*Report and Order*"), in the above-captioned proceeding.[1]

On August 25, 2003, Motorola, Inc (Motorola) filed a request for extension of time to file oppositions to the NPSTC Reconsideration Petition, asking that the initial date set for filing of oppositions to the Petition for Reconsideration filed by NPSTC be extended by thirty days, from September 2, 2003 to October 2, 2003 and replies to oppositions extended to October 14, 2003, allowing for further industry-public safety efforts to reach a compromise position. In its grant of the extension of time for filing comments, the Commission stated it believed that "significant

public interest benefits could be realized by allowing the public safety community and interested equipment vendors to continue ongoing discussions regarding deployment and development of 4.9 GHz band technologies in an effort to perhaps reach a consensus position.[2]" On October 2, 2003 Motorola, Inc ("Motorola") and Proxim Corporation ("Proxim") filed Comments that generally support the NPSTC Reconsideration Petition, but disagree with NPSTC with respect to the power levels at which the proposed emission masks would be required. Proxim is a provider of chipsets to Motorola.

With over 74,000 public safety organizations in the United States, it is critical to have a resource and an advocate for public safety telecommunications. That is the primary role of the National Public Safety Telecommunications Council. NPSTC is a federation of public safety associations that encourage and facilitate, through a collective voice, the implementation of Public Safety Wireless Advisory Committee (PSWAC) and 700 MHz Public Safety National Coordination Committee (NCC) recommendations. NPSTC explores emerging public safety telecommunications issues and technologies, and develops recommendations to appropriate governmental bodies to support the broad goals of promoting public safety telecommunications worldwide. Finally, NPSTC serves as a standing forum for the exchange of ideas and information regarding public safety telecommunications.

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[1] Public notice of the NPSTC Reconsideration Petition, filed in response to the Commission's *Memorandum Opinion and Order and Third Report and Order* in the above-captioned proceeding, was published in the Federal Register on August 18, 2003.

[2] See *Order Extending Time for Filing of Comments*, DA 03-2750, adopted August 27, 2003.

I. Introduction

Beginning with the development of the ANSI-102 series of standards (Project 25) in 1989, public safety radio entered a new paradigm. The public safety user community now is proactively involved in development of standards and technologies for use within our various radio services. With considerable operational and field expertise developed over many years of hands-on use, and with the support of our own highly qualified engineering staffs and those from governmental and private organizations such as the National Institute of Standards and Technology, the Institute for Telecommunications Sciences, and Syracuse Research Corporation, the public safety community is defining its requirements based upon tens of thousands of man-years of experience. No longer are we beholden to equipment manufacturers and suppliers to define our needs as they see them, often tainted by their internal business cases. Rather, we have defined a partnership where users and manufacturers work together to meet the needs of public safety users as defined by the public safety user community.

It is within this spirit of cooperation that NPSTC has had continuing discussions on related issues with Motorola and with Cisco Systems, Inc.[3] regarding the emissions masks and development of standards-based equipment within the band. As noted in NPSTC's Further Comments,[4] these discussions have been cordial and very beneficial, reaching consensus on all but one issue.

[3] See *Comments of Cisco Systems, Inc* filed August 5, 2003.

[4] See *Further Comments of the National Public Safety Telecommunications Council Regarding Its Petition for Reconsideration* filed October 2, 2003.

II. Areas of Agreement

We remain in agreement with the following issues raised in the original NPSTC Petition:

a. The Commission should adopt the DSRC-A mask (equivalent to IEEE 802.11a) and the DSRC-C masks for use in the 4.9 GHz public safety band.

b. The Commission should embrace a standards process as a further activity within this proceeding that will lead to the adoption of an ANSI-recognized standard within a period of 18-24 months. To further this effort, NPSTC and Motorola will present a proposal to the Private Radio Section of the Telecommunications Industry Association (TIA) at its October 2003 meeting, asking TIA to assemble appropriate portions of existing IEEE and related standards into a comprehensive suite to meet public safety's specific broadband needs in the 4.9 GHz band. This suite will then be brought to the Commission as a recommendation for a mandatory standard for the 4.9 GHz band, thus promoting maximum coordinated use of the spectrum and supporting interoperability. Because of its ongoing work with Project 25 and the FCC's National Coordination Committee, TIA is particularly familiar with the unique requirements of public safety communications, having insight that is not present within other Standards Definition Organizations operating under the ANSI umbrella. By assembling existing standards into a specific suite for public safety broadband, the time required for independent standards development is eliminated.

c. The Commission should adopt the same Regional Planning rules for the 4.9 GHz band as they implemented for the 700 MHz public safety band, with the exception that licensees in the 4.9 GHz band be permitted to implement systems prior to adoption of their regional plan subject to the stipulation that operations be brought into compliance with their regional plan once it is adopted.

III. Area of Disagreement

As previously noted, we have unfortunately come to an impasse with regard to 4.9 GHz implementation and public safety broadband market product availability in one critical area, that

being the maximum transmitter output power level at which the emission mask transitions from the DSRC-A (equivalent to the IEEE 802.11a) mask to the DSRC-C mask. While our discussions have continued since the initial filing deadline for this Petition, no resolution has been reached.

In its Comments, Proxim highlights the importance of interference protection, noting that the alternative would be simply to let public safety use the 5 GHz U-NII bands.[5] Proxim implies in its Comments that a higher technical level of interference protection is required for public safety users and that the Commission recognized these needs when it allocated this spectrum. It is NPSTC's position that the Commission recognized that public safety could not share a public band with unlicensed, and therefore uncontrolled, users where public safety would have no priority, nor any assurance of access to the spectrum to meet its critical communications needs. The Commission did not specifically seek tighter masks, noting in its own documents the need to leverage commercial products from adjacent bands to the maximum degree possible.

Proxim continues by highlighting the problems with interference in the 800 MHz band.[6] Again, from NPSTC's perspective, the interference in the 800 MHz band is the result of interleaving of incompatible technologies. It is not necessarily a simple OOBE issue, as the Commission and numerous user organizations have thoroughly discussed in that proceeding. It is NPSTC's position that this band, with the use of compatible standards-based equipment and appropriate regional planning, can be implemented using industry standard equipment from the

[5] *Comments of Proxim*, page 2.

[6] *Comments of Proxim*, page 3.

adjacent U-NII and DSRC bands employing the same masks and power levels, but modified to meet the specific frequency and channeling requirements of the 4.9 GHz band.

Finally, Proxim quotes the NPSTC Petition with regard to the optional use of tighter emission masks in certain situations in an attempt to justify the Commission imposing a uniformly tighter mask in across the country. It is NPSTC's position that regional planning committees may want to impose stricter standards for certain applications. For example, the video and control communications between a bomb robot and its control center may need extra protection. The Incident Commander, or the Communications Unit Leader[7] at the scene, will appropriately assign responding units to ensure that these operations are protected to the maximum degree possible.

In its Comments, Motorola discusses each of the three points raised in the NPSTC Reconsideration Petition. We acknowledge Motorola's general agreement with these points and particularly thank them for the major engineering effort they provided in trying to reach consensus on all of the issues. NPSTC is not going to undertake an exhaustive engineering analysis of the differing opinions regarding transmitter output power levels for the two proposed emission masks. Rather we acknowledge that the difference is primarily one of interpreting how systems will be deployed in different scenarios.

In its initial Reconsideration Petition, NPSTC noted that the interference circle surrounding users using the two masks differed by 30 feet, and only was shortened during the

[7] EMS, Fire and Police agencies across the country have embraced use of the Incident Command System during response to multi-agency incidents. As an incident grows, trained specialists in communications management (Communications Unit Leaders) are automatically deployed as part of the personnel build-up at the scene. These specialists will receive training in proper deployment of broadband wireless systems, just as they receive training today with the myriad of mission critical voice systems.

period that adjacent units were actually in contention for the channel. In its comments, Motorola contends that the 0 dBm power threshold is necessary to prevent denial of service in Personal Area Network (PAN) applications.[8] Motorola implies that 100% coverage without blockage is a requirement. NPSTC notes that few, if any, manufacturers promote 100% coverage for mission critical voice systems in the lower bands where coverage is far superior, usually settling at about 97% as the maximum that can be realistically attained. Furthermore, mission critical public safety voice systems are ALWAYS blocked for voice transmissions from other subscriber units when a unit is transmitting on an assigned channel or talkgroup. Several NPSTC members have already experienced multiple occasions where many co-located 802.11a/b users have shared the same access point, and indeed where there are several access points on the same channel with strong (greater than 10 dBm) overlapping signals, and noted no denial of service, just a slowing of throughput.[9]

Historically, public safety users have not adopted new technologies for mission critical applications. There is no reason to believe that the 4.9 GHz band will be used for mission critical applications until this technology has clearly been field proven for a number of years.

Motorola acknowledges agreement with the "preclusion" distances pertinent to the masks at various power levels.[10] We will now detail our disagreement, noting that the positions of NPSTC's technical representatives have been unanimous with regards to these following issues.

[8] *Comments of Motorola*, page 8.
[9] While not a scientific study, NPSTC notes that at the recent IEEE 802.11 meetings in San Francisco, there were perhaps 75-100 users packed into each of several meeting rooms, most of them equipped with 802.11 wireless cards on their laptop computers. There was no reported instance of denial of service from any user. This number of users would represent a very large public safety incident in the real world.
[10] *Comments of Motorola*, page 6.

IV. Effects of Adjacent Channel Interference

NPSTC disagrees with Motorola with regards to the effects that adjacent channel interference has upon operational communications. Our analysis does not show adjacent channel interference resulting in irreparable loss of communications. Any adjacent channel interferer will cause some level of degradation, no matter the mask employed. The degree of degradation depends upon the relative power levels of the desired and undesired signals; functions of the geographic separation of the desired and interference signal sources, the radiated power of each, and the adjacent channel power coupling between these sources (as well as other factors).

It is well known that the OFDM waveform is very forgiving with regard to adjacent channel interference, as interference effects are discretized onto the subcarriers of the OFDM symbol. Adjacent channel interference may cause complete loss of communications to a high symbol rate single carrier modulation, yet may only result in reduced data throughput to an OFDM waveform. Even channel equalization effects will only affect subcarriers that are subject to the higher adjacent channel power levels, not "wipe out" the entire set of subcarriers within the OFDM symbol. Our discussions with Cisco and others confirm this view.

In our visit to Motorola's laboratory facilities, NPSTC representatives were present at an adjacent channel interference test demonstration, one that utilized standard off-the-shelf 5 GHz 802.11a equipment. The results of this demonstration not only validated NPSTC's original analyses, filed in the original Reconsideration Petition, but also highlighted the robustness of the 802.11a modulation operating in the presence of adjacent channel interference. In fact, the modulation only "broke down" at the very edges or extrema of the "near-far" scenarios.

V. Operational Impact of Adjacent Channel Interference

NPSTC is a forward-looking organization with highly technical representation from all areas of public safety, and maintains dedicated and highly capable working groups within the 4.9 GHz and Software Defined Radio (SDR) areas, among others. NPSTC is active in SDR Forum activities, as well as within standards development organizations and activities such as the Internet Engineering Task Force (IETF), Dedicated Short Range Communications (DRSC), IEEE 802, and Telecommunications Industry Association (TIA). From this participation, it should be clear that NPSTC fully understands both the technical and operational aspects of public safety communications.

NPSTC has analyzed many 4.9 GHz communications scenarios, more than presented within the Motorola filing. These have been successfully vetted through the public safety community, including many regional planning committees (including Region 8, where first responders at the World Trade Center on September 11th were present).

Through the reviews of theses scenarios, we are confident that we will be able to control the effects of adjacent channel interference within an incident, knowing that interference (whether co- or adjacent-channel-based) will have some limiting effects on communications. However these effects *must* be tempered against market forces in order to leverage technology innovations and economies of scale.

NPSTC again stresses that *any* scenario has some inherent element of an operational command structure. It is ludicrous to assume that first responders are going to rush to an incident scene and initialize high data rate and video feeds without some sort of command and

control process in place. There must be a "sink" for this information before these large and numerous "sources" are turned on. In other words, in order for a high-speed video connection to be turned on, someone should be "watching it" on the other end. These spectrum resources are precious, so a command and control structure will always be necessary (e.g., to stop dozens of equivalent video feeds when all would be sending essentially the same information).

Finally, we should note that we have responded to Motorola directly with concerns regarding the scenarios incorporated in their October 2 filing. This response included alternative avenues for addressing interference and spectrum management at an incident, and the need to look at path loss exponents other than 2.0, and 2.4 (i.e., free space loss or nearly so). The latter is especially noteworthy to Motorola Scenario 3, since free space loss at 4.9 GHz is not realistic for incidents where "vehicles are located far away from the users due to terrain and deployment considerations". It is interesting to note that a path loss exponent of 3.0 in this case could likely make up much, if not all, of the additional 20 dB of adjacent channel isolation that is claimed to be required.

VI. Power Levels Pertinent to Mask Selection

The previous issue of disagreement culminates in the important area of mask selection vs. power levels. NPSTC very strongly asserts that equipment operating at transmitter output power levels of 100 mW (20 dBm) or less should be able to operate with the standard 802.11a or DSRC-A mask. Only equipment operating at transmitter power levels greater than 20 dBm should be subject to the more-stringent requirements of the DSRC-C mask.

DSRC Rules allow the nearly identical A and B Masks to operate at power levels up to 10 dBm, with the C mask utilized from 10 to 20 dBm. However, DSRC assumes high vehicle density, with little or no operational control of the mobile units. In any public safety scenario we can assume that some level of incident command structure is in place, allowing better control of interference within any incident response. This will enable the operation of equipment at transmitter power levels of up to 100 mW before Mask C operation is required.

VII. Minimum Modification to Equipment Required

In its discussion on chipsets, Motorola contends that the DSRC-A and DSRC-C masks can be used without modification of the chipsets by use of added external filtering, concluding that "adoption of the above emission mask requirements would enable the use of 802.11 OFDM-based technologies with minimal modification.[11]" Importantly, Motorola and Proxim both miss NPSTC's major point about leveraging use of commercial equipment. It is just that: the benefits to public safety will come from leveraging entire product lines, modified only to meet the different frequency band and channeling plan, modifications that generally will not require circuit board level changes. The proposed additions to the 802.11 standards series to provide added security, quality of service, power control and other requirements essential for public safety users do not impact the physical layer within the chipset; rather they are firmware changes to higher layers within the product.

[11] *Comments of Motorola*, page 9.

VIII. Marketplace Driven Cost & Technology Prevent a Niche Market

In broadband public safety implementations, we seek an environment that includes multiple manufacturers creating products and applications that benefit the public safety community. Marketplace driven cost and technology are critical to the initial and ongoing deployment of equipment in this new band. It is detrimental to both the public safety community and to the Commission's desire for an interoperable environment between agencies, including critical infrastructure, to reduce the marketplace and the availability of products by implementing 4.9 GHz rules that require any significant change to mass produced products, changes that many chipset and equipment manufacturers will find not cost effective for the small public safety market.

NPSTC's position remains that the IEEE-802 industry-supported DSRC-A (standard IEEE 802.11a) mask be applied for power levels of 20 dBm or less, such that little or no equipment modification would be necessary, giving more manufacturers an incentive to make equipment available within the band. At transmitter output power levels exceeding 20 dBm, the more stringent DSRC-C mask would be applied in order to provide additional adjacent channel and Out Of Band Emission (OOBE) protection. This would allow for use of IEEE 802.11a-based equipment (worldwide) and 802.11j-based equipment (built for the Japanese market) for lower than 20-dBm transmitter output power and DSRC-C and 802.16e equipment at levels higher than 20 dBm. Motorola and Proxim contend that the transmitter power output level at which the masks transition to tighter specifications would be better set within the 0-10 dBm range.

By requiring all licensees to utilize an emission mask that requires extensive modifications by the manufacturers to conform to the Commission's rules, the public safety community will be deprived of the choices they believe are most appropriate for their use in the band. Setting the maximum transmit power output within the range of 0-10 dBm would eliminate most existing US and Japanese IEEE 802.11a standards-based equipment, systems, and designs, as well as equipment designed for the proposed IEEE 802.11j standards serving the Japanese market that operates at 4.9 GHz. These lower limits make it undesirable to transition technologies and products to the US 4.9 GHz band. It is particularly important that US and Japanese regulatory requirements permit equipment to be produced and sold in both markets without undo restrictions.

Furthermore, it is NPSTC's belief that most broadband equipment introduced in the 4.9 GHz band will be able to handle both 4.9 GHz, and the 5 GHz bands (including the new U-NII and DSRC allocations) in order to be applicable in the Japanese market, providing public safety with significant additional capacity, while leveraging into the U-NII market as well. Public safety cannot tolerate a niche market, and we want to benefit from the research and innovation that is going into the evolution of 802.11 (and 802.16). It is critical to align this market with broader commercial markets to introduce competition, and foster technological innovation.

Finally, as noted in our Further Comments, it is important that public safety agencies be able to easily interface to private and corporate security and related systems operating in the adjacent 5 GHz U-NII bands from a single public safety terminal.

NPSTC stresses the need to minimize the amount of effort that IEEE 802.11a/j and DSRC manufacturers/vendors will need to make to offer 4.9 GHz equipment. The more changes

that are necessary, the smaller the list of equipment manufacturers will be for the 4.9 GHz band. Preliminary discussions with the vendor community have led NPSTC to believe that these changes will ultimately limit entrance into the 4.9 GHz US market.

IX. Conclusions

NPSTC urges the Commission to consider adopting within its Rules for the 4.9 GHz band those three items listed above that agree with the position of NPSTC as stated in its original Petition for Reconsideration. We further urge the Commission to allow standard DSRC-A (equivalent to 802.11a) emissions at transmitter output power levels of 20 dBm or less, and the DSRC-C mask for transmitter output power levels greater than 20 dBm.

Marketplace driven cost and technology are critical to the development of this market, providing the competitive environment public safety needs to meet its requirements in a cost effective manner, while at the same time leveraging the benefits of an adjacent market several orders of magnitude larger than the public safety market. Again, we must leverage not only chipsets, but entire product lines from both the United States and Japan to make the use of this band cost effective in today's era of tight budgets.

The Commission should adopt rules that will promote the routine use of this band by the largest possible public safety user community. Emission masks need to be adopted that promote everyday use, and are not restrictively designed to only address incidents that might happen once a year in a few locations around the country. In this latter situation, it will be up to the Incident Commander and/or Communications Unit Leader to ensure that broadband wireless equipment is properly deployed to minimize interference. Public safety operational personnel are highly

trained and skilled in managing these kinds of requirements, as demonstrated by the appropriate management of these larger incidents on a regular basis. The 4.9 GHz band simply adds a new dimension to this management challenge.

Respectfully submitted,

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